Self-efficacy and performance among sport studies students taking statistics

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Background and rationale

Sport studies courses typically involve modules in research methods and statistics. Knowledge of how data are gathered and analysed is often a necessary condition for critically analysing research. These skills are needed in a number of different modules, and importantly, form a large component of a dissertation taken at level three of an undergraduate degree. Anecdotal evidence suggests that Sport Studies students typically find statistics a difficult subject to learn. Low confidence might partly be due to their varied background in terms of mathematics experience. Students typically steer toward sport related courses out of an interest in sport, rather than a desire to learn statistical skills. The relevance of learning statistics to developing critical thinking skills is not immediately apparent to many sport students. Teaching Sport Studies students statistics tends to represent a serious challenge for lecturers.

Self-efficacy is defined as the levels of confidence individuals have in their ability to execute courses of action or attain specific performance outcomes (Bandura, 1977, 1982, 1997). Self-efficacy expectations are proposed to influence initiating behaviour, how much effort will be applied to attain an outcome, and the level of persistence applied to the task in the face of difficulties and setbacks (Bandura, 1997). Research findings show that high self-efficacy is associated with successful performance, although the strength of relationships tends to vary between studies. This finding has been found in the context of sport (Moritz, Feltz, Fahrbach, & Mack, 2000), academia (Multon, Brown, & Lent; 1991; Lane & Lane, 2001; Pajares, 1996), and work (Stajkovic & Luthans, 1998).

A variable that has been found to influence the strength of relationships between self-efficacy and performance measures is how self-efficacy is measured. Self-efficacy measures should assess perceptions of confidence toward factors important to the attainment of the behaviour of interest (Bandura, 1997; Lane & Lane, 2001; Moritz et al., 2000; Pajares, 1996). Self-efficacy measures should assess confidence estimates to perform behaviours required to deliver the actual performance. Thus, self-efficacy research should involve a thorough examination of the competencies that underpin performance. After developing a measure specific to post-graduate students, Lane and Lane (2001) found that self-efficacy predicted performance among post-graduate students. They found that having the intellectual ability to cope with course content, and being able to manage time were the most important competencies.

Aims and objectives

The aim of the project is to seek information that might lead to improved student learning regarding statistics. The research identifies the competences that students and lecturers perceive are needed for successful performance on a statistics module. Second, the research assesses the relationship between self-efficacy toward achieving these competences and performance on the module.

The research

Participants

Participants were 130 undergraduate Sport Studies students (Male: N = 82, Female N = 48; Age range 18 – 31 years) taking a Level 1 module in Research Methods and Statistics at a University in the West Midlands, United Kingdom. The sample represented 79% of all students registered on the module. The majority were full-time students who had gained the entrance criterion for registering for a degree. Participants were heterogeneous in terms of academic experience. Some participants had entered the University with three high grading GCSE A levels, while others had BTec National Diploma, with others entering University having taken an access course.

Procedures

In the first week of a 15-week module, students were asked to participate in some research that might lead to developing methods to improve teaching statistics. Students were given access to a module outline that described the aims and objectives of the module. It also contained the marking criteria for assignments and described skills needed to pass the module. These skills were module specific such as knowledge of statistical theory, or transferable in nature, such as using information technology. Students using an on-line learning internet site could access the module outline. Thus, all students could access the module outline even if they failed to attend lectures. As students with limited knowledge of information technology might struggle to get the module outline from the internet site, a seminar on using information technology was conducted in week 2 of the module.

During week 3, students were asked students what competencies they believed were needed for success on the module. It is suggested that students had acquired some knowledge of the demands of the task. An open-ended questionnaire was used to identify factors perceived by students to be associated with success in the module. For example, students were encouraged to describe competencies needed to succeed in great depth. It was stressed that there were no right or wrong answers. Participants were assured of absolute confidentiality, each completing the questionnaires alone.

Measures of self-efficacy

Students described 44 different competencies perceived as needed for success. Competencies described remaining focused on lesson content throughout the lecture and listening to pick out key points throughout lectures and was labelled Lecture behaviour. They also described competencies related to using computers and computer software packages such as the Statistical Package for the Social Sciences (SPSS). A third category of competencies described trying to improve motivation. Examples include 'motivating yourself to read extra research around the topic area' and 'keeping trying, even if you don't fully understand, and remaining enthusiastic your work'. A fourth category described competencies related to managing time such as organising time and getting work completed on time. A fifth factor described items that describe confidence to analyse data. Examples include correctly analysing data, selecting the important results, and getting to grips with what the numbers mean. It was labelled statistical theory. Examples include remaining patient, getting information from textbooks, and passing the module.

The next step in the research was to use competencies to develop a self-efficacy measure. The phrase 'How confident are you in your ability to' …insert competency….was used as the basis developing the self-efficacy measure. This approach is consistent with previous research (Bandura, 1997). It is proposed that participants should rate their confidence using a 5-point scale. We acknowledge that Bandura (1997) has used a 100-point scale (1-100) to assess confidence, arguing that efficacy estimates are best assessed using a rating scale analogous to a percentage. We decided to anchor no confidence around the number zero.

Logically, participants should find it easier to understand that zero refers to no confidence at all, rather than a score of 1 refers to no confidence at all.

Measure of performance.

Performance was assessed using assessment grades for assignment 1 and assessment grades for assignment 2. Both sets of marks involve second marking and moderation. A number of other performance measures were taken. We used percentage usage of material for student usage of the Wolverhampton Online Learning Framework (WOLF). All lectures and relevant information was contained on WOLF. Accessing this information should be associated with increased knowledge, and thus increased self-efficacy to pass the course.

A second indicator of performance was a self-assessment mark for worksheets performed by students. The worksheets asked students to complete a task relevant to the one performed in the assignment. Students marked their own work using an answer sheet. The lecturer recorded the mark. The limitations of this approach in terms of validity and accuracy of the self-assessment mark are acknowledged.

Previous performance.

We asked students to record their educational qualifications in terms of GCSE, A level or equivalents. We asked students to rate their academic performance so far in terms of a percentage. High percentage scores would reflect how successful they perceived themselves to be. We also asked students to report the extent to which success is attributed to effort, ability, or luck.

Outcomes

Descriptive statistics for self-efficacy and performance are contained in Table 1 and correlation results are contained in Table 2. Results indicate that self-efficacy toward the first assignment correlated significantly with assignment 1 scores. High self-efficacy was associated with better marks. Self-efficacy was assessed at the start of the module, and then a week before submitting the assignment. Self-efficacy scores taken one week before submission showed a stronger relationship with assignment 1 scores than efficacy measures taken at the start of the course, suggesting that students had a clearer understanding of the demands of the task. Self-assessment marks correlated significantly with self-efficacy measures, suggesting that higher marks on worksheets were associated with self-efficacy toward passing. It is interesting to note that self-assessment marks did not significantly correlate with assignment 1 scores.

For assignment 2, results show that self-efficacy toward passing assignment 2 had the strongest relationship. There appears to be a clear path for relationships between self-efficacy and performance. Self-efficacy toward assignment 1 predicted assessment 1 scores; and assessment 1 scores predicted subsequent self-efficacy scores.

Table 1. Descriptive Statistics

	M	SD
GCSE Points	8.55	1.90
A Level Points	7.00	2.37
Percentage success so far	72.04	12.53
Success Attributed to Effort	47.67	15.31
Success Attributed to Ability	42.18	14.34
Success Attributed to Luck	10.05	9.39
WOLF usage (percentage)	43.40	16.64
Worksheet marks (self-assessment)	7.17	1.11
Self-efficacy at the start of the module (1)	111.53	16.51
Self-efficacy before handing in Assignment 1 (2)	110.66	15.64
Self-efficacy before handing in Assignment 2 (3)	115.42	16.15
Assignment 1 Grade	10.51	2.02
Assignment 2 Grade	10.64	2.01

Table 2. Correlations among variables

	ASS1	ASS2	EFF11	EFF12	EFF3	WOLF	MARKS	PERC	EFFOR	ABILITY	LUCK	GCSE
Assignment 1	1.00											
Assignment 2	.39	1.00										
Efficacy 1	.26	.20	1.00									
Efficacy 2	.34*	.31*	.79*	1.00								
Efficacy 3	.35*	.51*	.66*	.80*	1.00							
Wolf usage	.20	.18	.06	.09	.13	1.00						
Marks	.03	.10	.29*	.37*	.23	-.12	1.00					
Percentage success	.16	.18	.18	.16	.21	.20	-.08	1.00				
Effort	.14	.12	-.06	.18	.27*	.30*	.09	.34*	1.00			
Ability	-.03	-.09	.14	-.02	-.16	-.27*	.06	-.27*	-.80*	1.00		
Luck	-.19	-.06	-.10	-.31*	-.22	-.14	-.26	-.13	-.40*	-.22*	1.00	
GCSE points	.01	-.28*	-.05	-.06	-.08	.01	.21	-.08	.14	-.17	.05	1.00
A level points	-.04	-.06	-.10	-.02	-.02	.07	-.08	-.14	-.00	-.05	.07	-.08

* $p < .05$

Benefits

There are several benefits deriving from the present study. It is generally agreed that applied interventions should be founded on theory and research. Theory based research is deemed advantageous because theories delimit the nature of the research, preventing the researcher from being overwhelmed by the vast number of possible variables that could be assessed. In the present study, self-efficacy theory was investigated in the context of a Level 1 Research Methods module. Findings of the present study lend support to the notion that efficacy expectations are related to performance (see Table 2). In addition, results show that there is a reciprocal relationship between performance and self-efficacy. As Table 2 indicates, self-efficacy toward assignment 1 predicted performance in assignment 1, which in turn predicted subsequent self-efficacy measures.

Knowledge of factors related to performance can assist develop interventions to improve performance. In the present study, the module was structured to give students a clear understanding of the task, and thus confidence estimates would reflect real expectations of success. Findings from the present study can be used to guide interventions. First, performance accomplishments (percentage success, GVSE points etc) showed no significant relationships with perceived self-efficacy or performance. Therefore, although these measures of performance are available at the start of a module, or course, they did not show predictive validity. This suggests that rather than looking at performance accomplishments already achieved, lecturers should assess confidence to achieve future performance when looking at research methods.

Measures taken on the course reflecting performance accomplishments showed significant relationships with self-efficacy. In particular, students completed worksheets and marked their own work. Self-assessment is clearly desirable from a lecturer's perspective as it saves time. Findings from the present study suggest that the influence of self-assessment on performance in the module is mediated by self-efficacy judgements. Self-efficacy perceptions related to self-assessment of performance, which in turn related to subsequent self-efficacy measures.

We assessed WOLF usage through the percentage uptake of work loaded on WOLF. Relationships indicated that this showed no relationship with self-efficacy or performance. However, we suggest that percentage uptake is too crude an indicator. There were no WOLF based assessments available at the time of the study. Future research should investigate relationships between activities and assessments performed on WOLF and self-efficacy. The benefits of such activities over gaining feedback via self-assessment are that WOLF is more objective.

Collectively, the benefits of the research are that factors associated with performance have been identified. Future research and interventions to improve student performance can target these variables.

Evaluation

As Table 1 indicates, the average mark on the module was a grade of a C10/B11. Student feedback was also positive. Previous module evaluations had reported student dissatisfaction. Students reported favourably on using WOLF to provide a running commentary on student issues (this was done through the 'forum' section on WOLF).

Future developments

This line of investigation can be furthered in several ways. One suggestion is to write worksheets that differentiate by level of ability. Weaker students need more in-depth explanation and students that are more able need extending. WOLF can used as the platform for allowing students to access differentiated work.

References

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. Psychological Review, 84, 191-215.

Bandura, A. (1982). Self-efficacy mechanisms in human agency. American Psychologist, 37, 122-147.

Bandura, A. (1997). Self-efficacy: The exercise of control. New York: W.H. Freeman.

Lane, J., & Lane, A. M. (2001). Self-efficacy and academic performance. *Social Behavior and Personality, 29*, 687-694.

Moritz, S.E., Feltz, D.L., Fahrbach, K.R., & Mack, D.E. (2000). The relation of self-efficacy measures to sport performance: A meta-analytic review. Research Quarterly for Exercise and Sport, 71, 280–294.

Multon, K. D., Brown, S. D., & Lent, R. W. (1991). Relation of self-efficacy beliefs to academic outcomes: A meta-analytical investigation. Journal of Counselling Psychology, 38, 30-38.

Pajares, F. (1996). Self-efficacy beliefs in academic settings. Review of Educational Research, 66, 543-578.

Stajkovic, A. D., & Luthans, F. (1998). Self-efficacy and work-related performance: A meta-analysis. Psychological Bulletin, 124, 240-261.